

# STATUS OF THE PALLID STURGEON

## *Scaphirhynchus albus*

Larry Kallemeyn

### ABSTRACT

Information presented concerning the pallid sturgeon, *Scaphirhynchus albus*, was compiled from published and unpublished papers, from personal communications with numerous biologists, and from the results of a survey of 45 agencies and individuals. Pallid sturgeon occur in the Missouri River and the lower half of the Mississippi River and certain of their tributaries. Of the 250 pallids that were reported, approximately 76% were collected from the Missouri River in Montana and the Dakotas. Because of the rarity of this species, information on its life history is limited. Regression equations were developed for the length-weight relationships of pallids from two Missouri River reservoirs. The apparent rarity of the pallid sturgeon and the lack of knowledge concerning it has prompted 9 of the 13 states within its range to classify it as either threatened or endangered or to give it some other special recognition. The Endangered Species Committee of the American Fisheries Society has also classified it as threatened throughout its range. Additional information is needed on its habitat requirements if it is to be protected from habitat destruction or modification.

The pallid sturgeon, *Scaphirhynchus albus*, is one of the larger and lesser known North American freshwater fishes. Little information has been collected on this riverine species since it was first recognized by Forbes and Richardson (1905). The two principal published information sources are a review of the systematics of the genus *Scaphirhynchus* (Bailey and Cross 1954) and a summary of age, length, and weight data (Carlander 1969). The principal objectives of this report were to update and summarize all available information on *S. albus*.



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Information was obtained from published literature, unpublished papers and reports, and through personal communications with numerous biologists. Information was requested by letter from 45 agencies and individuals and responses were received from 37. All responses are in the author's files at Voyageurs National Park and are available for review. Three of the principal data sources were reports prepared by South Dakota Game, Fish and Parks; North Central Reservoir Investigations, U.S. Fish and Wildlife Service personnel on their work on the Missouri River reservoirs in South Dakota; and a sturgeon study conducted by Missouri Department of Conservation personnel.

### TAXONOMY

Forbes and Richardson (1905) were the first to differentiate the pallid sturgeon from the shovelnose sturgeon, *Scaphirhynchus platyrhynchus*. They named the pallid sturgeon *Parascaphirhynchus albus* and proposed that *Parascaphirhynchus* be recognized as a new genus. Berg (1911), however, refused to accept this and placed *albus* in *Scaphirhynchus*, an interpretation accepted by Bailey and Cross (1954) and Bailey and Allum (1962). *Scaphirhynchus albus* (Forbes and Richardson) is the scientific name recognized by the American Fisheries Society for the pallid sturgeon. Common names for the pallid sturgeon include white sturgeon, white shovelnose, and white hackleback, all of which undoubtedly originated because of its light color.

Carlson and Pflieger (1981), using analysis of proportional body measurements, fin ray counts, and other external features, found evidence of hybridization between *S. albus* and *S. platyrhynchus*. Electrophoretic analysis of tissues from the presumed hybrids and pallid and shovelnose sturgeon found them to be identical at all 52 loci that were examined (Phelps and Allendorf 1979). Carlson and Pflieger (1981) concluded these results provided no supportive evidence for or against their identification of the hybrids but that they did suggest a close genetic relationship between the pallid and shovelnose sturgeon.



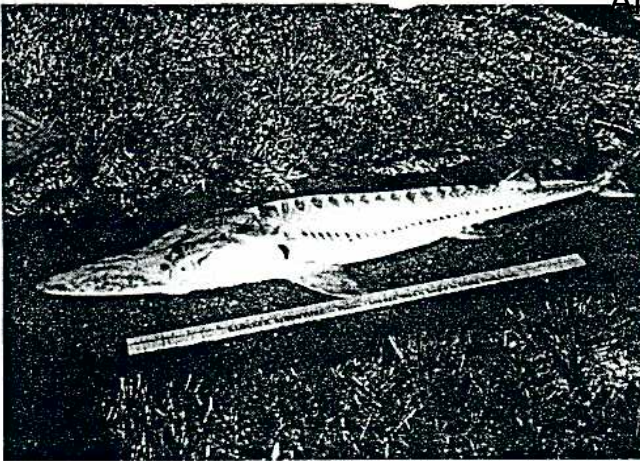


Figure 1. Pallid sturgeon, *Scaphirhynchus albus* (FL 1315 mm, 9 kg) Missouri River, Hughes Co., South Dakota, May 1976. Photo courtesy of Fish and Wildlife Service.

## DESCRIPTION

All river sturgeons (*Scaphirhynchus*) are characterized by a flattened, shovel-shaped snout; long, slender, depressed, and completely armored caudal peduncle; prolonged upper lobe of the caudal fin; and the absence of a spiracle (Smith 1979). The principal morphological features which distinguish the pallid sturgeon from the shovelnose sturgeon are the absence of bony plates on the belly, 37 or more dorsal fin rays, 24 or more anal fin rays, bases of the outer barbels usually behind those of the inner barbels, and the length of the inner barbels going more than 6 times into the head length (Pflieger 1975). Pallid sturgeon are usually light brown on the dorsal surface and white on the ventral side (Fig. 1). Although in most instances the pallid is lighter than the shovelnose, coloration cannot consistently be relied upon as a means of separating the two species.

## DISTRIBUTION

Bailey and Cross (1954) described the range of *S. albus* as being the Missouri-Mississippi River proper from Fort Peck Reservoir, Montana, to New Orleans, Louisiana, and the Kansas River upstream to Lawrence, Kansas. Since 1954, pallid sturgeon have been collected from the Fort Benton-Great Falls, Montana, vicinity to the mouth of the Missouri River with the largest number of specimens having come from the mainstem impoundments in the Dakotas. The recent collections in the Fort Benton area (Berg, pers. comm.), which is approximately 240 km upstream from Fort Peck Reservoir, suggest that a large sturgeon from that area described by Cope (1879) was also a pallid sturgeon.

In the Mississippi River, an immature sturgeon taken in the vicinity of Keokuk, Iowa, and identified by Coker (1930) as *S. albus* remains the most upstream record. However, the fact that no other pallid sturgeon have been reported from the Mississippi River in Iowa, northern Illinois, Minnesota, or Wisconsin indicates the principal range is downstream of the Illinois River mouth, which is the type locality for the species (Forbes and Richardson 1905). From this location south, at least one pallid sturgeon has been reported from every state bordering the Mississippi River, except Kentucky. The farthestmost downstream the species has been collected is the New Orleans, Louisiana, vicinity (Bailey and Cross 1954). Hoese and Moore (1977)

indicated pallid sturgeon may rarely enter low-salinity waters in Louisiana but presented no data to validate this point.

Bailey and Cross (1954) stated they expected the known range to be extended, particularly into the major turbid tributaries of the Mississippi and Missouri Rivers. This has not proven to be the case, as pallids have been collected only from four tributaries, the Yellowstone, Platte, Kansas and St. Francis Rivers. The Yellowstone River in Montana and North Dakota is the only one where *S. albus* has been observed regularly (Peterman and Haddix 1975; Elser, pers. comm.). This regular occurrence may be associated with the Yellowstone's having mean flows which are approximately 100 m<sup>3</sup>/sec greater than those of the Missouri River upstream from its confluence with the Yellowstone. Pallid sturgeon have been collected in the Yellowstone as far upstream as the mouth of the Tongue River, which is approximately 300 km upstream from the Missouri River (Brown 1971). Other Missouri River tributaries in which the species has been found include the Platte River, where one sturgeon was caught in 1979 approximately 30 km upstream from the Missouri and the Kansas River near Lawrence, Kansas, where six pallid sturgeon were captured in 1952 (Thomas pers. comm., Bailey and Cross 1954). Cross (1967) indicated the occurrence of the sturgeon in the Kansas River was associated with the 1951 floods. Since 1952 there have been no verified reports of the pallid sturgeon in the river and Cross (pers. comm.) now doubts that the species is a regular resident of the Kansas River basin. The only record of a pallid sturgeon from a Mississippi River tributary is of a fish that was caught in 1963 in the St. Francis River near Madison, Arkansas (Buchanan 1973).

## ABUNDANCE

The additional collecting effort that has taken place since 1954 has done nothing to disprove Bailey and Cross's (1954) statement that the species is "nowhere common." Of the 250 pallid sturgeon reported, approximately 76% were collected from the Missouri River in Montana and the Dakotas; most were collected in the five mainstem reservoirs that were created during the 1950's and 1960's (Table 1). During the past 25 years, hundreds of gill, trammel, and trap net sets and hauls with seines and trawls have been made in these reservoirs by state, federal, and university biologists. Even with this intensive effort, relatively few pallid sturgeon have been captured.

The largest number of pallid sturgeon other than from the upper Missouri River were reported from the Missouri and Mississippi Rivers in or adjoining Missouri. Observations other than from these areas have occurred infrequently and from a variety of locations. The species is apparently rare throughout the range, particularly in comparison to the shovelnose sturgeon (Table 2). Conner (pers. comm.), while agreeing the species is rare in the Mississippi River, indicated the relative inefficiency of most sampling gears in large rivers contributes to its apparent rareness. This may also be the case in the unimpounded reaches of the upper Missouri River where relatively few pallid sturgeon have been captured in comparison to the numbers that have been caught in the reservoirs.

## HABITAT

The preferred habitat of the pallid sturgeon is apparently the main channel of large, turbid rivers such as the Missouri and Mississippi. It is a bottom-dwelling fish which usually occurs in



Table 1. Recorded observations of pallid sturgeon throughout its range.

State, river segment	Number of fish	Source of information
<b>Montana</b>		
Missouri River above Fort Peck Reservoir	6	Brown 1971, Needham pers. comm., Berg pers. comm.
Fort Peck Reservoir	6	Bailey and Cross 1954, Brown 1971, Needham pers. comm.
Missouri River below Fort Peck Reservoir	1	Brown 1971, Needham pers. comm.
Yellowstone River	2	Brown 1971
<b>North Dakota</b>		
Yellowstone River	2	Berard pers. comm.
Missouri River, Lake Sakakawea	13	Berard pers. comm.
Missouri River, Lake Oahe	5	Higham 1967
<b>South Dakota</b>		
Missouri River, Lake Oahe	66	Bailey and Allum 1962, Higham 1967, Warnick pers. comm., Fogle 1961a, b, 1963a, b
Missouri River, Lake Sharpe	64	June in press, Krumm pers. comm., Hicks pers. comm.
Missouri River, Lake Francis Case	5	Gasaway 1970
Missouri River below Ft. Randall Dam	3	Bailey and Allum 1962, Kallemeyn 1975, Kallemeyn and Novotny 1977
Missouri River, Lewis and Clark Lake	17	Walburg 1964
Missouri River below Gavins Point Dam	3	Bailey and Allum 1962, Walburg <i>et al.</i> 1971, Schmulbach <i>et al.</i> 1975
<b>Iowa</b>		
Missouri River	2	Baldwin pers. comm.
Mississippi River	1	Coker 1930
<b>Nebraska</b>		
Missouri River	1	Feit pers. comm.
Platte River	1	Thomas pers. comm.
<b>Kansas</b>		
Missouri River	0 <sup>a</sup>	Cross pers. comm., Groen pers. comm.
Kansas River	6	Bailey and Cross 1954
<b>Missouri</b>		
Missouri River	15	Carlson and Pflieger 1981, Pflieger 1975
Mississippi River	6	Carlson and Pflieger 1981
<b>Illinois</b>		
Mississippi River	12	Smith 1979
<b>Kentucky</b>		
Mississippi River	0	Bowers pers. comm.
<b>Tennessee</b>		
Mississippi River	2	Etnier pers. comm.
<b>Arkansas</b>		
Mississippi River	1	Buchanan 1973
St. Francis River	1	Buchanan 1973
<b>Mississippi</b>		
Mississippi River	1	Mississippi Power and Light Company 1973
<b>Louisiana</b>		
Mississippi River	8	Bailey and Cross 1954, Douglas 1974, N.E. Louisiana University

<sup>a</sup>Commercial fishermen have reported catching pallid sturgeon in this river reach.

swifter water than does the closely related shovelnose sturgeon (Forbes and Richardson 1909). The species preference for riverine conditions is also evident in that a significant portion of those fish collected in Missouri River mainstem reservoirs have come from the upstream ends where more riverine conditions

exist (Moen 1969; Higham 1967; June in press). Pallids, however, have been collected throughout the reservoirs and in Lake Oahe at depths up to 24 m (Warnick pers. comm.).

(Continued)

Table 2. Numbers of pallid and shovelnose sturgeon captured in various studies.

Location	Shovelnose sturgeon	Pallid sturgeon	Shovelnose: pallids	Information source
Lewis and Clark Lake	1075	17	63:1	Walburg 1964
Lake Oahe	1725	46	38:1	Fogle 1961a, b, 1963a, b
Lake Sharpe	3393	61	56:1	June in press
Lake Francis Case	1005	5	201:1	Gasaway 1970
Missouri River, South Dakota	6392	1	6392:1	Schmulbach et al. 1975
Missouri River, South Dakota	247	1	247:1	Kallemeyn and Novotny 1977
Missouri River, South Dakota	62	3	21:1	Bailey and Cross 1954
Mississippi River	—	—	300:1	Forbes and Richardson 1909
Kansas River	—	—	20:1	Cross 1967

### AGE AND GROWTH AND LENGTH-WEIGHT RELATIONSHIPS

Reported age and growth measurements for pallid sturgeon are extremely limited. Fogle (1963b), using cross sections of pectoral fin rays, aged and back calculated lengths from six sturgeon from Lake Oahe, South Dakota (Table 3). Growth of the Oahe fish was relatively rapid during the first four years but annual increments decreased to approximately 70 mm per year between ages five and ten. Carlson and Pflieger (1981) presented ages and lengths from eight fish from the Missouri and Mississippi Rivers in Missouri. Growth of these fish was slightly slower than that of the South Dakota sturgeon. June (in press) found that individuals in gill-net catches in Lake Sharpe, South Dakota, ranged from age XII to XXVII.

Length-weight relationships of pallid sturgeon between 400 and 1200 mm long from two of the Missouri River mainstem reservoirs in South Dakota were similar (Figure 2). Up to a length of 600 mm or an age of 6 or 7 years, sturgeon increase in length fairly rapidly but there is relatively little increase in weight. From that length on, however, the rate of length increments decreases while the rate of weight increments increases. Length and weight measurements from fish longer than 1200 mm from other areas indicate that growth continues to be mainly in weight as the fish grow older (Berard pers. comm.; Walburg 1964).

While there are unconfirmed reports of individuals that weighed over 45 kg being taken by commercial fishermen in Fort Peck

Reservoir (Brown 1971), the largest recorded specimen was a 30.8-kg fish that was taken from the Missouri River in North Dakota (Bailey and Allum 1962). Several individuals have also been reported that weighed between 10 and 20 kg. Indeed, their large size is probably the chief factor contributing to these reports since several of them were taken by anglers and commercial fishermen.

### FOOD

Fish and aquatic insects have been the principal items found in the few pallid sturgeon stomachs that have been examined. The stomach of the fish from the Mississippi River Coker (1930) identified as a pallid sturgeon contained 90% fish remains while a pallid from the unchannelized Missouri River in southeastern South Dakota contained two sauger (Modde, pers. comm.). Carlson and Pflieger (1981) found that fish were also important in the diet of *S. albus* from Missouri, but substantial numbers of immature aquatic insects were also eaten. Aquatic insects and small fish were also the principal items in the stomachs of pallid sturgeon from the Kansas River (Cross 1967).

### REPRODUCTION

Information on reproduction of the pallid sturgeon is extremely limited. No investigator has ever reported locating the spawning beds or observing the spawning act. Spawning reportedly occurs

Table 3. Calculated growth of pallid sturgeon, Lake Oahe, 1962. (Fogle 1963b).

Number of fish	Age	Total length (mm) at end of year									
		1	2	3	4	5	6	7	8	9	10
1	V	284	399	513	683	742	—	—	—	—	—
1	VII	251	376	439	627	691	754	815	—	—	—
1	VIII	312	437	498	592	655	716	780	874	—	—
1	IX	307	419	505	589	701	757	813	869	925	—
2	X	259	320	432	475	518	566	627	709	795	881
Average length		279	378	470	574	638	672	732	790	838	881
Fork length*		241	334	421	519	579	611	668	723	768	808

\*Total length converted to fork length using the formula  $F.L. = \frac{T.L. - 24.02}{1.06}$  derived by Moos (1978) for shovelnose sturgeon.



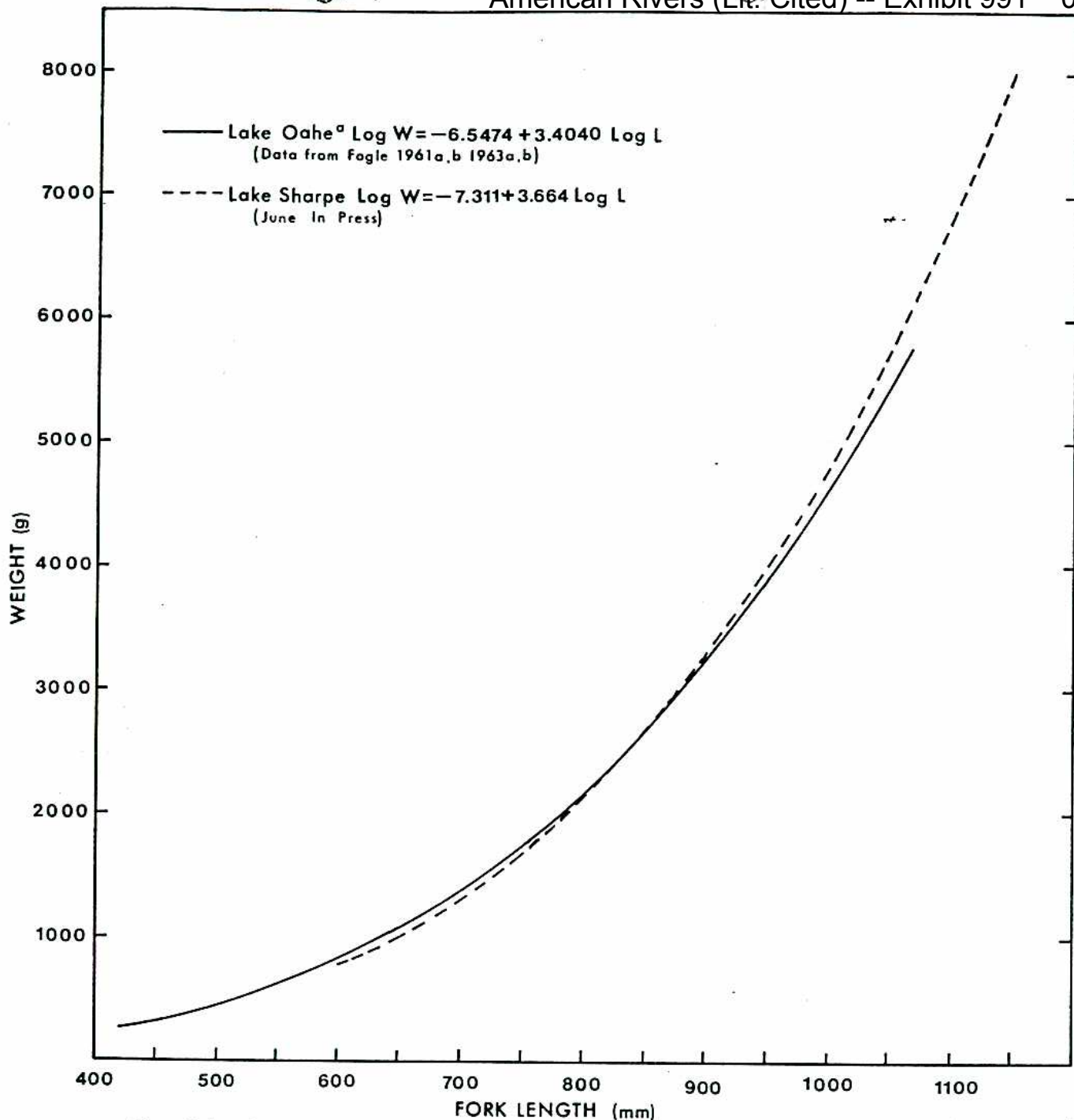


Figure 2. Length-weight relationship of pallid sturgeon from two Missouri River Reservoirs. <sup>a</sup>Total lengths of Lake Oahe fish were converted to fork lengths using the formula

$$FL = \frac{TL - 24.02}{1.06}$$

derived by Moos (1978) for shovelnose sturgeon

between June and August (Forbes and Richardson 1909). Females collected in June and July in Lake Sharpe, a mainstem Missouri River reservoir, contained mature ova and presumably were ready to spawn (June in press). Ten years of sampling for young-of-the-year fish in the reservoir, however, produced no evidence of successful reproduction. It is conceivable that most of the spawning habitat of the sturgeon like that of the paddlefish, another large riverine species, was destroyed when the reservoirs were created. Paddlefish reproduction no longer occurs in those

Missouri River reservoirs where the river channel was completely inundated (Friberg 1973).

Maturity in male pallid sturgeon occurred when the fish were 3 to 4 years old and had reached lengths of 533 to 584 mm (Fogle 1961b). Age and size of maturity for females is unknown as is whether they have an extended reproductive cycle as do female shovelnose and lake sturgeon. Shovelnose sturgeon spawn every 2 to 3 years while lake sturgeon spawn at 4- to 5-year intervals (Moos 1978; Roussow 1957). (Continued)



## HARVEST

Most pallid sturgeon are taken incidentally by anglers and commercial fishermen while they are fishing for other species. Several respondents to my letters indicated commercial fishermen in their areas were able to distinguish the pallid from the shovelnose sturgeon and that they did occasionally mention capturing a pallid. Smaller pallids, however, probably go unnoticed since in most instances the fishermen rely on size and color to differentiate the two species. Unfortunately, most of these catches are probably not reported except in those instances when an exceptionally large fish is caught.

The fact pallid sturgeon are not usually distinguished from shovelnose sturgeon in commercial catch records further contributes to the paucity of information on harvest. The two are lumped together in the catch records from the Missouri River mainstem reservoirs in South Dakota, but because of the net mesh sizes used in the fishery, it is assumed most of the reported sturgeon are *S. albus*. Gasaway (1970) reported that most of the 328 sturgeon harvested from Lake Francis Case from 1959 to 1968 were pallids, while the commercial catch records for Lake Oahe for the years 1964–71 show that 112 sturgeon were landed. In neither reservoir, however, did the catch per net ever rise above a trace. Pallid sturgeon have never been distinguished in the commercial catch records in Missouri either.

Anglers are known to take a few pallids every year. In most instances, these catches are probably not recorded because the anglers either can't identify the fish or are required to release it because of its threatened or endangered status in their state.

## DISCUSSION

The pallid sturgeon has apparently always been rare throughout its range. Forbes and Richardson (1905) in the original description of the species indicated its scarcity had undoubtedly kept it from being recognized earlier. They quoted Mr. H. L. Ashlock, a commercial fishermen, who estimated that only about one in five hundred of the sturgeon in the central Mississippi River was actually a pallid sturgeon. The proportion of pallids has been higher than this in some recent catches, but nowhere is the species nearly as common as the shovelnose sturgeon. *S. albus* is unquestionably rare; however, a portion of this rareness may be due to the inefficiency of sampling methods that are used in large rivers.

This rareness and the fact that most commercial catch records for sturgeon have not differentiated between species make it difficult to establish whether there have been any significant changes in abundance of *S. albus*. Some circumstantial evidence does exist which indicates the species may have declined in abundance. Sturgeon in the Missouri River in Missouri, which includes lake, shovelnose, and pallids, were once common but they are now considered to be rare (Funk and Robinson 1974). Commercial fishermen in the Kansas portion of the Missouri River report they hardly ever see "white" sturgeon anymore (Cross pers. comm.). Schmulbach (pers. comm.) reported that during the early 1960's anglers caught large pallid sturgeon from the Missouri River in southeastern South Dakota. Since then he has not heard of any pallids being caught even though there has been a considerable increase in fishing effort.

The circumstantial evidence of decreases in abundance has come primarily from areas that have undergone significant habitat modification. Either the riverine habitat has been eliminated completely by the construction of dams or it has undergone

significant changes due to channel modification projects. The lack of knowledge concerning the specific requirements of the pallid sturgeon precludes saying exactly what the impact of the habitat changes has been. However, the fact that other riverine species such as paddlefish and shovelnose sturgeon have been found to be adversely affected by such changes suggests that the impact on the pallid sturgeon may have been similar. Habitat destruction or modification has been identified by the Endangered Species Committee of the American Fisheries Society as the principal threat to the pallid sturgeon (Deacon et al. 1979).

The impact of overfishing on sturgeon in the United States is generally well documented (Dees 1961), but it is difficult to say exactly what the impact was on the pallid sturgeon since they were not distinguished in the catch records. It is doubtful, however, if the rareness of *S. albus* protected it from exploitation since it apparently was vulnerable to the fishing methods that were being used to capture other species. The current impact of fishing is probably minimal because of the regulations that have been enacted. The rarity of the pallid sturgeon and the lack of knowledge concerning it has prompted 9 of the 13 states within its range either to place it on their threatened or endangered species list or to give it some other special recognition (Table 4). The Endangered Species Committee of the American Fisheries Society has also classified the pallid sturgeon as threatened throughout its range (Deacon et al. 1979). In most states where the species has been formally classified, fishing regulations required the release of any pallid sturgeon. Montana's regulation, which requires the release of any sturgeon weighing over 16 pounds, was established to protect pallid sturgeon while allowing fishing to continue for the smaller, more abundant shovelnose sturgeon. This weight limit was selected because Montana records include no pallid sturgeon under 20 pounds and no shovelnose sturgeon over 16 pounds.

## MANAGEMENT IMPLICATIONS

Management of the pallid sturgeon has been hindered by the dearth of sound scientific information concerning its life history and habitat requirements. Management until now has been limited to the enactment of special regulations to restrict the harvest of sturgeon. Unfortunately, while these regulations may prevent


Table 4. Legal status of pallid sturgeon in the 13 states within its range.

State	Classification	Regulation
Arkansas	None	—
Iowa	Endangered	Must release
Illinois	Rare	—
Kansas	Threatened	Must release
Kentucky	None	—
Louisiana	None	—
Missouri	Endangered	Must release
Mississippi	None	—
Montana	Special Concern	Must release any sturgeon over 16 lb.
Nebraska	Threatened	Must release
North Dakota	Threatened	—
South Dakota	Threatened	Must release
Tennessee	Wildlife in Need of Management	—



the harvest of a few fish, they do nothing to protect the species from the many forms of habitat alteration that are continually occurring in the rivers it inhabits. If we are going to provide the pallid sturgeon long-term protection from those threats, we are first going to have to identify what the critical habitat conditions for the species are. With this knowledge we can then attempt to protect the remaining natural habitat or to restore or develop new areas of suitable habitat. Interstate coordination of both management and research concerning the pallid sturgeon would seem appropriate since the Missouri and Mississippi Rivers, the principal habitat of the species, serve as common boundaries between many states.

## ACKNOWLEDGMENTS

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